| **Grade** | **Big Idea** | **Essential Questions** | **Concepts** | **Competencies** | **Vocabulary** | **Standard** | **Eligible Content** |
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| **PreK-2** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence. | Describe and predict the patterns in the seasons of the year  Recognize, classify, and record patterns in the phenomena they observe (e.g., sun, moon, sky, seasons).  Observe, use, and describe patterns in the natural and human designed world, and use as evidence. | Pattern  Seasons  Design  Phenomena  Evidence  Classify | 3.1.3.B5  3.1.4.B5  3.3.4.B2 | S4.A.3.3 |
| **PreK-2** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena and designed products. | Investigate characteristics that allow classification of animal types (e.g., mammals, fish, insects), of plants (e.g., trees, shrubs, grasses), or of materials (e.g., wood, rock, metal, plastic). | Characteristics  Materials  Analyze  Similarities  Differences | 3.1.3.B5  3.1.4.B5  3.3.4.B2 | S4.A.3.3 |
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| **3-4** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Cyclic patterns of change related to time can be used to make predictions. | Predict next occurrences of patterns in objects of the natural world (e.g., seasons, leaf, lunar phases). | Cyclic Patterns  Occurrence  Prediction | 3.1.3.B5  3.1.4.B5  3.3.4.B2 | S4.A.3.3 |
| **3-4** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena and designed products. | Analyze patterns in rates of change (e.g., for example, the growth rates of plants under different conditions).  Classify and sort objects based upon similarities and differences. | Similarities  Differences  Sort  Classify  Designed Products  Natural Phenomena | 3.1.3.B5  3.1.4.B5  3.3.4.B2 | S4.A.3.3 |
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| **5-6** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Macroscopic patterns are related to the nature of microscopic and atomic-level structure. | Compare and contrast observable patterns in physical characteristics. | Compare  Contrast  Characteristics  Microscopic  Macroscopic  Atomic-Level | 3.1.7.B5  3.1.8.B5  3.2.8.B6 | S8.A.3.3 |
| **5-6** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. | Identify and describe patterns that occur in physical systems. | Physical System  Human Designed System | 3.1.7.B5  3.1.8.B5  3.2.8.B6 | S8.A.3.3 |
| **5-6** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Patterns can be used to identify cause and effect relationships. | Identify repeating structure patterns.  Make predictions based upon observable patterns. | Cause and Effect  Predications | 3.1.7.B5  3.1.8.B5  3.2.8.B6 | S8.A.3.3 |
| **5-6** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Graphs and charts can be used to identify patterns in data. | Make predictions based upon data acquired in an investigation. |  | 3.1.7.B5  3.1.8.B5  3.2.8.B6 | S8.A.3.3 |
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| **7-8** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Macroscopic patterns are related to the nature of microscopic and atomic-level structure. | Relate and compare patterns to the nature of microscopic and atomic-level structure. | Macroscopic  Microscopic  Atomic-Level Structure | 3.1.7.B5  3.1.8.B5  3.2.8.B6 | S8.A.3.3 |
| **7-8** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. | Examine and describe recurring patterns to classify both living and nonliving objects. | Rates of Change | 3.1.7.B5  3.1.8.B5  3.2.8.B6 | S8.A.3.3 |
| **7-8** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Patterns can be used to identify cause and effect relationships. | Describe physical patterns in motion. |  | 3.1.7.B5  3.1.8.B5  3.2.8.B6 | S8.A.3.3 |
| **7-8** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Graphs and charts can be used to identify patterns in data. | Utilizing data acquired in an investigation, identify patterns with the data utilizing graphic organizers. | Graphic Organizer | 3.1.7.B5  3.1.8.B5  3.2.8.B6 | S8.A.3.3 |
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| **9-12** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. | Observed at each of the scales at which a system is studied. Thus classifications used at one scale may fail or need revision when information from smaller or larger scales is introduced (e.g., classifications based on DNA comparisons versus those based on visible characteristics). |  | 3.1.B.A8  3.1.10.B5  3.1.B.B5  3.1.12.B5  3.1.B.C3  3.2.10.B6  3.2.P.B6  3.3.12.A7  3.3.12.B2 |  |
| **9-12** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Classifications or explanations used at one scale may fail or need revision when information from smaller or larger scales is introduced; thus requiring improved investigations and experiments. | Design an investigation utilizing patterns that produces accurate results. | Investigation  Classification  Explanation | 3.1.B.A8  3.1.10.B5  3.1.B.B5  3.1.12.B5  3.1.B.C3  3.2.10.B6  3.2.P.B6  3.3.12.A7  3.3.12.B2 |  |
| **9-12** | Patterns: Observed patterns of forms and events guide organization and classification and they prompt questions about relationships and the factors that influence them. | How do patterns predict the outcome of an event? | Patterns of performance of designed systems can be analyzed and interpreted to reengineer and improve the system. Mathematical representations are needed to identify some patterns. | Utilize mathematics to present data in multiple forms for analysis. | Patterns of Performance | 3.1.B.A8  3.1.10.B5  3.1.B.B5  3.1.12.B5  3.1.B.C3  3.2.10.B6  3.2.P.B6  3.3.12.A7  3.3.12.B2 |  |
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| **PreK-2** | Cause and Effect: Causal relationships and their mechanisms can be tested and used to predict and explain events in new contexts. | What is the relationship between cause and effect? | Events have causes that generate observable patterns. Simple tests can be designed to gather evidence to support or refute student ideas about causes. | Identify events that generate observable patterns.  Design a simple test to gather evidence to support or refute student ideas about causes. | Simple Test |  | S4.A.2.1 |
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| **3-4** | Cause and Effect: Causal relationships and their mechanisms can be tested and used to predict and explain events in new contexts. | What is the relationship between cause and effect? | Cause and effect relationships are routinely identified, tested, and used to explain change. Events that occur together with regularity might or might not be a cause and effect relationship. | Describe events that demonstrate cause and effect. | Cause and Effect Relationship |  | S4.A.2.1 |
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| **5-6** | Cause and Effect: Causal relationships and their mechanisms can be tested and used to predict and explain events in new contexts. | What is the relationship between cause and effect? | Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. Cause and effect relationships may be used to predict phenomena in natural or designed systems. | Explain the cause and effect of the creation of a canyon. | Causation |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.3.2 |
| **7-8** | Cause and Effect: Causal relationships and their mechanisms can be tested and used to predict and explain events in new contexts. | What is the relationship between cause and effect? | Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. | Use mathematics to demonstrate the relationship between cause and effect. |  |  | S8.A.1.1  S8.A.1.2  S8.A.1.3  S8.A.3.2 |
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| **9-12** | Cause and Effect: Causal relationships and their mechanisms can be tested and used to predict and explain events in new contexts. | What is the relationship between cause and effect? | Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. | Analyze data to demonstrate cause and effect relationships. | Empirical Evidence |  |  |
| **9-12** | Cause and Effect: Causal relationships and their mechanisms can be tested and used to predict and explain events in new contexts. | What is the relationship between cause and effect? | Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. | Develop and analyze the parts of a system and the impact the parts will have on the system. | Mechanisms |  |  |
| **9-12** | Cause and Effect: Causal relationships and their mechanisms can be tested and used to predict and explain events in new contexts. | What is the relationship between cause and effect? | Systems can be designed to cause a desired effect. Changes in systems may have various causes that may not have equal effects. | Change a system to demonstrate the impact of a change on a system. |  |  |  |
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| **PreK-2** | Scale, Proportion, and Quantity: Changes in scale, proportion, and quantity affect a system’s structure and/or performance. | How do changes in structure and performance affect a system? | Relative scales allow objects to be compared and described (e.g., bigger and smaller; hotter and colder; faster and slower). Standard units are used to measure length, weight, temperature. | Describe and compare objects as a relative scale. | Relative Scale  Standard Unit  Length  Weight  Temperature  Bigger  Smaller | 3.3.4.A6  3.3.4.B2 | S4.A.2.2  S4.A.3.2 |
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| **3-4** | Scale, Proportion, and Quantity: Changes in scale, proportion, and quantity affect a system’s structure and/or performance. | How do changes in structure and performance affect a system? | Relative scales allow objects to be compared and described (e.g., bigger and smaller; hotter and colder; faster and slower). Standard units are used to measure length, weight, temperature. | Describe and compare objects as a relative scale. | Relative Scale | 3.3.4.A6  3.3.4.B2 | S4.A.2.2  S4.A.3.2 |
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| **5-6** | Scale, Proportion, and Quantity: Changes in scale, proportion, and quantity affect a system’s structure and/or performance. | How do changes in structure and performance affect a system? | Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. The observed function of natural and designed systems may change with scale. | Create a model (e.g., a bridge) to demonstrate how a change in structure will impact the performance of the system. | Model  Space  Time  Energy  Phenomena | 3.2.6.B6  3.3.6.A6  3.3.7.A6  3.3.7.B2  3.3.8.B2 | S8.A.2.1  S8.A.3  S8.A.3.2 |
| **5-6** | Scale, Proportion, and Quantity: Changes in scale, proportion, and quantity affect a system’s structure and/or performance. | How do changes in structure and performance affect a system? | Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. | Modify a structure to demonstrate performance changes within the system. | Structure  Proportional Relationship | 3.2.6.B6  3.3.6.A6  3.3.7.A6  3.3.7.B2  3.3.8.B2 | S8.A.1.3  S8.A.2.1 |
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| **7-8** | Scale, Proportion, and Quantity: Changes in scale, proportion, and quantity affect a system’s structure and/or performance. | How do changes in structure and performance affect a system? | Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. The observed function of natural and designed systems may change with scale. | Create a model (e.g., a bridge) to demonstrate how a change in structure will impact the performance of the system. | Model  Space  Time  Energy  Phenomena | 3.2.6.B6  3.3.6.A6  3.3.7.A6  3.3.7.B2  3.3.8.B2 | S8.A.2.1  S8.A.3  S8.A.3.2 |
| **7-8** | Scale, Proportion, and Quantity: Changes in scale, proportion, and quantity affect a system’s structure and/or performance. | How do changes in structure and performance affect a system? | Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. | Modify a structure to demonstrate performance changes within the system. | Structure  Proportional Relationship | 3.2.6.B6  3.3.6.A6  3.3.7.A6  3.3.7.B2  3.3.8.B2 | S8.A.1.3  S8.A.2.1 |
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| **9-12** | Scale, Proportion, and Quantity: Changes in scale, proportion, and quantity affect a system’s structure and/or performance. | How do changes in structure and performance affect a system? | Scientific relationships can be represented through the use of algebraic expressions and equations. | Examine data mathematically to demonstrate changes. | Scientific Relationship | 3.1.B.B5  3.2.10.B6  3.2.P.B6  3.3.10.A7  3.3.10.B2  3.3.12.B2 |  |
| **9-12** | Scale, Proportion, and Quantity: Changes in scale, proportion, and quantity affect a system’s structure and/or performance. | How do changes in structure and performance affect a system? | The significance of a phenomena is dependent on the scale, proportion, and quantity at which it occurs. Some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to observe directly. Patterns observable at one scale may not be observable or exist at other scales. | Utilize a model to describe a system that is too large, small, or fast, and explain the use of the model. |  | 3.1.B.B5  3.2.10.B6  3.2.P.B6  3.3.10.A7  3.3.10.B2  3.3.12.B2 |  |
| **9-12** | Scale, Proportion, and Quantity: Changes in scale, proportion, and quantity affect a system’s structure and/or performance. | How do changes in structure and performance affect a system? | Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. | Describe and compare models utilizing different scales. |  | 3.1.B.B5  3.2.10.B6  3.2.P.B6  3.3.10.A7  3.3.10.B2  3.3.12.B2 |  |
| **9-12** | Scale, Proportion, and Quantity: Changes in scale, proportion, and quantity affect a system’s structure and/or performance. | How do changes in structure and performance affect a system? | Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). | Examine data to predict change in a variable. |  | 3.1.B.B5  3.2.10.B6  3.2.P.B6  3.3.10.A7  3.3.10.B2  3.3.12.B2 |  |
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| **PreK-2** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Objects and organisms can be described in terms of their parts. Systems in the natural and designed world have parts that work together. | Construct and interpret models with diagrams, written or oral communication.  Describe objects or organisms in terms of their parts and the roles those parts play in the functioning of the object or organism. | Objects  Organisms  Models | 3.1.4.A8 | S4.A.3.1  S4.A.3.2  S4.A.3.3 |
| **PreK-2** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. A system can be described in terms of its components and interactions. | Use models to demonstrate physical changes as materials change as temperature rises or decreases (e.g., water).  Describe parts of systems in the natural and designed world that work together. | System  Natural World  Designed World  Physical Change | 3.1.4.A8 | S4.A.3.1  S4.A.3.2  S4.A.3.3 |
|  |  |  |  |  |  |  |  |
| **3-4** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Objects and organisms can be described in terms of their parts. Systems in the natural and designed world have parts that work together. | Construct and interpret models with diagrams, written or oral communication.  Describe objects or organisms in terms of their parts and the roles those parts play in the functioning of the object or organism, and note the relationships between the parts. | Model | 3.1.4.A8 | S4.A.3.1  S4.A.3.2  S4.A.3.3 |
| **3-4** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. A system can be described in terms of its components and interactions. | Use models to demonstrate physical changes as materials change as temperature rises or decreases (e.g., water).  Create plans that another child can follow. |  | 3.1.4.A8 | S4.A.3.1  S4.A.3.2  S4.A.3.3 |
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| **5-6** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Systems may interact with other systems; they may have subsystems and be part of larger complex systems. | Discuss interactions within a system. | Complex System | 3.1.7.A8  3.3.6.B2 | S8A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Models can be used to represent systems and their interactions--such as inputs, processes, and outputs--and energy matter, and information flows within systems. | Create models that explicitly state the invisible features of a system (e.g., interactions, energy flows, matter transfers, etc.) | Input  Output  Processes | 3.1.7.A8  3.3.6.B2 | S8A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Models are limited in that they only represent certain aspects of the system under study. | Apply appropriate models to demonstrate interactions. |  | 3.1.7.A8  3.3.6.B2 | S8A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions -- including energy, matter, and information flows -- within and between systems at different scales. | Create models of earth’s common physical features. | Models | 3.1.7.A8  3.3.6.B2 | S8A.3.1  S8.A.3.2  S8.A.3.3 |
| **5-6** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. | Utilize satellite images to identify earth’s resources. |  | 3.1.7.A8  3.3.6.B2 | S8A.3.1  S8.A.3.2  S8.A.3.3 |
|  |  |  |  |  |  |  |  |
| **7-8** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Systems may interact with other systems; they may have subsystems and be part of larger complex systems. | Discuss interactions within a system. |  | 3.1.7.A8  3.3.6.B2 | S8A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Models can be used to represent systems and their interactions--such as inputs, processes, and outputs--and energy matter, and information flows within systems. | Create models that explicitly state the invisible features of a system (e.g., interactions, energy flows, matter transfers, etc.) |  | 3.1.7.A8  3.3.6.B2 | S8A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Models are limited in that they only represent certain aspects of the system under study. | Apply appropriate models to demonstrate interactions. |  | 3.1.7.A8  3.3.6.B2 | S8A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions -- including energy, matter, and information flows -- within and between systems at different scales. | Create models of earth’s common physical features. |  | 3.1.7.A8  3.3.6.B2 | S8A.3.1  S8.A.3.2  S8.A.3.3 |
| **7-8** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. | Utilize satellite images to identify earth’s resources |  | 3.1.7.A8  3.3.6.B2 | S8A.3.1  S8.A.3.2  S8.A.3.3 |
|  |  |  |  |  |  |  |  |
| **9-12** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Systems can be designed for specific tasks. | Design a system model for a specific task. |  | 3.1.B.A8  3.2.10.A5  3.2.C.A5  3.2.12.A5  3.2.10.B6  3.2.P.B6  3.3.10.A7  3.3.12.A7 |  |
| **9-12** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. | Create models that explicitly state the invisible features of a system (e.g., interactions, energy flows, matter transfers, etc.) |  | 3.1.B.A8  3.2.10.A5  3.2.C.A5  3.2.12.A5  3.2.10.B6  3.2.P.B6  3.3.10.A7  3.3.12.A7 |  |
| **9-12** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions -- including energy, matter, and information flows -- within and between systems at different scales. | Develop appropriate models to demonstrate interactions between systems at different scales. |  | 3.1.B.A8  3.2.10.A5  3.2.C.A5  3.2.12.A5  3.2.10.B6  3.2.P.B6  3.3.10.A7  3.3.12.A7 |  |
| **9-12** | Systems and System Models: Scientists develop and use system models to represent current understandings, aid in developing questions and experiments, and to communicate ideas to others. | How and why do scientists develop and use models? | Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. | Discuss and develop models to demonstrate interactions within systems. |  | 3.1.B.A8  3.2.10.A5  3.2.C.A5  3.2.12.A5  3.2.10.B6  3.2.P.B6  3.3.10.A7  3.3.12.A7 |  |
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| **PreK-2** | Energy and Matter (flows, cycles, and conservation): The flow of energy and matter into, out of, and within systems can be tracked to understand the systems’ possibilities and limitations. | How does the flow of energy contribute to the functioning of a system? | Objects may break into smaller pieces, be put together into larger pieces or change shapes. | Draw a diagram of how objects may break into smaller pieces and be put together into larger pieces, or change shapes | Energy  Matter  Flow  Cycle  Conservation | 3.2.3.B6  3.2.4.B6 | S4.A.1.3 |
| **PreK-2** | Energy and Matter (flows, cycles, and conservation): The flow of energy and matter into, out of, and within systems can be tracked to understand the systems’ possibilities and limitations. | How does the flow of energy contribute to the functioning of a system? | Matter is made of particles. Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. matter is transported into, out of, and within systems. | Explain a system to demonstrate the conservation of matter. | Particles | 3.2.3.B6  3.2.4.B6 | S4.A.1.3 |
| **PreK-2** | Energy and Matter (flows, cycles, and conservation): The flow of energy and matter into, out of, and within systems can be tracked to understand the systems’ possibilities and limitations. | How does the flow of energy contribute to the functioning of a system? | Energy can be transferred in various ways and between objects. | Demonstrate the use of a system model to represent the transfer of energy. | System | 3.2.3.B6  3.2.4.B6 | S4.A.1.3 |
|  |  |  |  |  |  |  |  |
| **3-4** | Energy and Matter (flows, cycles, and conservation): The flow of energy and matter into, out of, and within systems can be tracked to understand the systems’ possibilities and limitations. | How does the flow of energy contribute to the functioning of a system? | Objects may break into smaller pieces, be put together into larger pieces or change shapes. | Create a model to represent the flow of energy in a system. | Model | 3.2.3.B6  3.2.4.B6 | S4.A.1.3 |
| **3-4** | Energy and Matter (flows, cycles, and conservation): The flow of energy and matter into, out of, and within systems can be tracked to understand the systems’ possibilities and limitations. | How does the flow of energy contribute to the functioning of a system? | Matter is made of particles. Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. matter is transported into, out of, and within systems. | Using a model that explains the conservation of matter. |  | 3.2.3.B6  3.2.4.B6 | S4.A.1.3 |
| **3-4** | Energy and Matter (flows, cycles, and conservation): The flow of energy and matter into, out of, and within systems can be tracked to understand the systems’ possibilities and limitations. | How does the flow of energy contribute to the functioning of a system? | Energy can be transferred in various ways and between objects. | Using a model, describe the transfer of energy within a system. |  | 3.2.3.B6  3.2.4.B6 | S4.A.1.3 |
|  |  |  |  |  |  |  |  |
| **5-8** | Energy and Matter (flows, cycles, and conservation): The flow of energy and matter into, out of, and within systems can be tracked to understand the systems’ possibilities and limitations. | How does the flow of energy contribute to the functioning of a system? | Matter is conserved because atoms are conserved in physical and chemical processes. Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. | Create a model that demonstrates the conservation of matter within a natural system. | Conservation of Matter | 3.2.6.B6  3.2.7.B6 | S8.A.3.1 |
| **5-8** | Energy and Matter (flows, cycles, and conservation): The flow of energy and matter into, out of, and within systems can be tracked to understand the systems’ possibilities and limitations. | How does the flow of energy contribute to the functioning of a system? | Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system. | Demonstrate models that replicate the transfer of energy throughout a system. | Transfer | 3.2.6.B6  3.2.7.B6 | S8.A.3.1 |
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| **9-12** | Energy and Matter (flows, cycles, and conservation): The flow of energy and matter into, out of, and within systems can be tracked to understand the systems’ possibilities and limitations. | How does the flow of energy contribute to the functioning of a system? | The total amount of energy and matter in closed systems is conserved. | Create a closed system that demonstrates the conservation of matter. | Closed System |  | S8.A.3.1 |
| **9-12** | Energy and Matter (flows, cycles, and conservation): The flow of energy and matter into, out of, and within systems can be tracked to understand the systems’ possibilities and limitations. | How does the flow of energy contribute to the functioning of a system? | Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. Energy cannot be created or destroyed--it only moves between one place and another place, between objects and/or fields, or between systems. | Create a systems model that demonstrates the movement of energy between systems. |  |  | S8.A.3.1 |
| **9-12** | Energy and Matter (flows, cycles, and conservation): The flow of energy and matter into, out of, and within systems can be tracked to understand the systems’ possibilities and limitations. | How does the flow of energy contribute to the functioning of a system? | Energy drives the cycling of matter within and between systems. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. | Create a model of atoms within a nuclear process and explain that they are not conserved. |  |  | S8.A.3.1 |
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| **PreK-2** | Structure and Function: The way in which an object or living thing is shaped and its substructures determine many of its properties and functions. | How is form related to function? | The shape and stability of structures of natural and designed objects are related to their function(s). | Explore how shape and stability are related to their function for a variety of structures.  Describe the relationships of structure and mechanical function (e.g., wheels and axles, gears).  Describe common functions living things share to help them function in a specific environment. | Function  Structure  Designed Object | 3.1.4A5 | S4.B.1 |
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| **3-4** | Structure and Function: The way in which an object or living thing is shaped and its substructures determine many of its properties and functions. | How is form related to function? | The shape and stability of structures of natural and designed objects are related to their function(s). | Explore how shape and stability are related for a variety of structures.  Examine subsystems of the human body and describe the relationship of the shapes of the parts to their functions. | Subsystem | 3.1.4.A5 | S4.B.1 |
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| **5-6** | Structure and Function: The way in which an object or living thing is shaped and its substructures determine many of its properties and functions. | How is form related to function? | Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore, complex natural and designed structures/systems can be analyzed to determine how they function. | Examine subsystems of different systems and describe the relationship of the shapes of the parts to their functions. |  | 3.1.5.A5  3.1.6.A5 | S8.A.3.1  S8.B.1.1 |
| **5-6** | Structure and Function: The way in which an object or living thing is shaped and its substructures determine many of its properties and functions. | How is form related to function? | Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. | Design structures based upon functions to be performed and shape materials for specific uses. |  | 3.1.5.A5  3.1.6.A5 | S8.A.3.1  S8.B.1.1 |
|  |  |  |  |  |  |  |  |
| **7-8** | Structure and Function: The way in which an object or living thing is shaped and its substructures determine many of its properties and functions. | How is form related to function? | Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore, complex natural and designed structures/systems can be analyzed to determine how they function. | Develop a model based on atoms and/or molecules and their motions to explain properties of solids, liquids, and gases. | Atom  Molecule  Microscopic | 3.1.7.A5 | S8.A.3.1  S8.B.1.1 |
| **7-8** | Structure and Function: The way in which an object or living thing is shaped and its substructures determine many of its properties and functions. | How is form related to function? | Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. | Develop a model of a gas as a collection of moving particles related to properties of gases. |  | 3.1.7.A5 | S8.A.3.1  S8.B.1.1 |
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| **9-12** | Structure and Function: The way in which an object or living thing is shaped and its substructures determine many of its properties and functions. | How is form related to function? | Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. | Develop models to explain systems and processes (e.g., structure of water and salt molecules, Earth’s plate tectonics, etc.). |  | 3.1.10.A5  3.1.B.A5  3.1.12.A5 |  |
| **9-12** | Structure and Function: The way in which an object or living thing is shaped and its substructures determine many of its properties and functions. | How is form related to function? | The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. | Design system that includes the application of relationships of structure and function as critical elements of a successful design. |  | 3.1.10.A5  3.1.B.A5  3.1.12.A5 |  |
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| **PreK-2** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Some things stay the same while other things change. Things may change slowly or rapidly. | Compare individual growth with the growth of a plant.  Discuss how some things stay the same while other things change. |  | 3.3.4.A6  3.2.3.A5  3.1.3.C3  3.1.4.C3 | S4.A.3.1 |
| **PreK-2** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Different materials have different substructures, which can sometimes be observed. Substructures have shapes and parts that serve functions. | Compare objects (living or nonliving) according similarities and differences. | Compare  Similarities  Differences | 3.3.4.A6  3.2.3.A5  3.1.3.C3  3.1.4.C3 | S4.A.1.3  S4.A.3.1 |
| **PreK-2** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Some stable systems are static while others change in different ways. Some systems appear stable, but over long periods of time will eventually change. | Identify evidence from objects that provides basis of change over time. | Evidence  Stable System | 3.3.4.A6  3.2.3.A5  3.1.3.C3  3.1.4.C3 | S4.A.1.3  S4.A.3.1 |
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| **3-4** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Some things stay the same while other things change. Things may change slowly or rapidly. | Compare the types of erosion with different objects. |  | 3.3.4.A6  3.2.3.A5  3.1.3.C3  3.1.4.C3 | S4.A.1.3  S4.A.3.1 |
| **3-4** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Different materials have different substructures, which can sometimes be observed. Substructures have shapes and parts that serve functions. | Compare objects (living or nonliving) according similarities and differences. |  | 3.3.4.A6  3.2.3.A5  3.1.3.C3  3.1.4.C3 | S4.A.1.3  S4.A.3.1 |
| **3-4** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Some stable systems are static while others change in different ways. Some systems appear stable, but over long periods of time will eventually change. | Identify evidence from objects that provides basis of change over time. | Evidence | 3.3.4.A6  3.2.3.A5  3.1.3.C3  3.1.4.C3 | S4.A.1.3  S4.A.3.1 |
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| **5-6** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. | Utilizing evidence, describe the changes the Earth is undergoing over time. |  | 3.3.7.A6  3.2.6.A5  3.1.7.C3  3.1.8.A8 | S8.A.3.3 |
| **5-6** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Small changes in one system might cause large changes in another part. Stability might be disturbed either by sudden events or gradual changes that accumulate over time. Systems in dynamic equilibrium are stable due to a balance of feedback mechanisms. | Describe the impact on one system caused by another system. |  | 3.3.7.A6  3.2.6.A5  3.1.7.C3  3.1.8.A8 | S8.A.3.3 |
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| **7-8** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. | Utilizing evidence drawn from fossils, discuss how things have changed over time. |  | 3.3.7.A6  3.3.8.A6  3.2.6.A5  3.1.7.C3  3.1.8.A8 | S8.A.3.3 |
| **7-8** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Small changes in one system might cause large changes in another part. Stability might be disturbed either by sudden events or gradual changes that accumulate over time. Systems in dynamic equilibrium are stable due to a balance of feedback mechanisms. | Describe the impact on one system caused by another system. |  | 3.3.7.A6  3.3.8.A6  3.2.6.A5  3.1.7.C3  3.1.8.A8 | S8.A.3.3 |
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| **9-12** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Much of science deals with constructing explanations of how things change and how they remain stable. Change and rates of change can be quantified and modeled over very short or very long periods of time. | Analyze data to determine the rate of change within a system. |  | 3.1.10.A8  3.1.B.A8  3.1.12.A8  3.1.B.B5  3.1.10.C3  3.1.B.C3  3.1.12.C3  3.2.12.A5  3.2.10.B6  3.2.P.B6  3.2.12.B6  3.3.10.A7  3.3.12.A7  33.10.A7  3.3.12.A7  3.3.10.B2  3.3.12.B2 |  |
| **9-12** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Some system changes are irreversible. | Provide examples of changes within systems that are irreversible. |  | 3.1.10.A8  3.1.B.A8  3.1.12.A8  3.1.B.B5  3.1.10.C3  3.1.B.C3  3.1.12.C3  3.2.12.A5  3.2.10.B6  3.2.P.B6  3.2.12.B6  3.3.10.A7  3.3.12.A7  33.10.A7  3.3.12.A7  3.3.10.B2  3.3.12.B2 |  |
| **9-12** | Stability and Change: For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. | What is the importance of stability and/or change in a system? | Feedback (negative or positive) can stabilize or destabilize a system. | Demonstrate how one can stabilize a system through the use of a model. |  | 3.1.10.A8  3.1.B.A8  3.1.12.A8  3.1.B.B5  3.1.10.C3  3.1.B.C3  3.1.12.C3  3.2.12.A5  3.2.10.B6  3.2.P.B6  3.2.12.B6  3.3.10.A7  3.3.12.A7  33.10.A7  3.3.12.A7  3.3.10.B2  3.3.12.B2 |  |